INDUSTRIAL-ARTS AND PREVOCATIONAL EDUCATION IN JUNIOR HIGH SCHOOLS

EDGERTON

Industrial-Arts and Prevocational Education

in Intermediate and Junior-High Schools

By

A. H. Edgerton

Assistant Professor of Vocational Education

Indiana University

The Bruce Publishing Co.

Milwaukee Wisconsin

Printed in U. S. A.

PREFACE

It is hoped that both the general and detailed explanations of actual procedure involved in several of these courses and projects may aid instructors and administrators in determining the relative possibilities in the different plans for realizing common aims or purposes. Numerous requests for such specific information during the past few months have made it evident that there is an increasing demand for this type of material when interpreted in terms of the results obtained and the means employed. In order that all concerned might derive the most help from these valuable reports, it has been decided to present them in connection with the findings and implications resulting from this investigation of 379 intermediate and junior-high schools.

This and other recent investigations clearly show that tradition, rather than present-day need, still too largely determines the purpose, content, and method of the industrial subjects in the seventh, eighth, and ninth years. Nevertheless, these suggestive reports of the rapid developments in intermediate and junior-high schools are so many evidences of a serious attempt to prepare our pupils for efficient service and more intelligent citizenship. Today, as never before, it is evident that the larger values in industrial or manual arts education can not be realized alone from the mere doing and making of things, where skill in the manipulation

of materials, tools and machines is the main objective. If industrial activities are to play a large part in meeting the problems of general education, is it not reasonable to expect them to share the responsibility for helping boys to develop perspective and thinking power in connection with real life situations? The importance of skill and knowledge should be recognized as a factor in general education; however, should not these be vitalized through such concrete experiences as will stimulate thought and actually make a difference in the lives of our pupils as members of families and of vocational and civic groups?

In many of the upper grade curricula, the time allowed for information and shopwork has been quite limited. However, many schools are attempting to represent several types of industrial activities in order that their pupils may have a more complete understanding of industry and likewise be prepared to make intelligent choices of both educational opportunities and life occupations. Some administrators and teachers have had the courage to consider the school shops and local enterprises somewhat as field laboratories where pupils may investigate important methods, products, conditions, and requirements in the various divisions of industry. As a result of these studies, which are unlimited in possibilities, boys are brought in contact not only with materials, tools, machines, and processes of manipulation but also with worthwhile information con-

cerning the work and the workers in each activity represented.

Although recent, the rapid growth of intermediate schools or junior-high schools represents a serious attempt to assist all children, regardless of their social status or possible life work, in meeting the new and changing demands for many-sided service. This growing tendency to respect individual differences by providing partial differentiation (from one-third to one-half of the school time) during the seventh, eighth and ninth grades, assumes that *pupils should be provided with the kinds and qualities of knowledge and skill (or dexterity) which will help them to establish those habits, attitudes, and appreciations that contribute most to their daily conduct as intelligent citizens, consumers, and producers.*

The selected reports on a number of carefully planned and successfully developed industrial-arts courses and projects were prepared by teachers and supervisors having somewhat varied points of view and results. These contributions were collected by the industrial-Arts Committee of the National Society for the Study of Education and are published in this usable form by special request. The various statements of experience encountered in offering the different activities to meet the needs and interests of early adolescence should prove suggestive to all concerned.

While it is encouraging to note these marked improvements in methods and procedure, it certainly would be unwise at this time to consider any stereotyped plan as more than tentative. These promising results should point the way for further experimentation, which is certain to make more reliable comparisons and measurements possible. If industrial-arts courses are to continue to occupy an important place in the program for general education, the relative possibilities in the different plans for realizing common objectives must be determined more scientifically than heretofore. Our future practices should be based upon established fact, as far as possible, rather than chiefly upon opinion, which naturally is variable. In other words, there apparently is an increasing need for scientifically determining how to modify our present methods in order to have seventh, eighth, and ninth year boys learn most effectively and economically.

Acknowledgment is gratefully made to the many teachers and administrators who so generously aided the writer in securing and interpreting data for the various comparative studies included in this publication, and also to those who have cooperated by contributing brief reports of their experience in successfully developing courses and projects. Words of thanks are due Mr. L. A. Herr of the Lincoln School, New York City, and Mr. G. H. Hargitt of the Ben Blewett Junior

High School, St. Louis, Mo., for their able assistance in selecting and adapting these reports. The writer also is under obligation to those whose published works have been referred to in presenting the results of these investigations. Especial indebtedness is expressed to Professor F. G. Bonser of Teachers College, Columbia University, for his encouragement in formulating and publishing the studies, as well as for his helpful editorial criticism.

A. H. E.

CONTENTS

I. Meeting Present-Day Needs.

II. Organizing and Conducting Representative Activities.

CONTENTS

III. Methods of Offering Courses and Projects.

Industrial-Arts and Prevocational Education in Our Intermediate and Junior-High Schools

I. Meeting Present Day Needs

Industrial Experiences as a Means of General Education.

N keeping with the rapid changes in our social and industrial development, there are growing evidences that an increasing number of schools are seriously attempting to prepare boys and girls to meet the new demands for efficient service as members of families and of vocational and civic groups. Perhaps the most noticeable indication of this step has been the decided change in the *purpose, content,* and *method* of the work now offered both in industrial courses as a means of general education and in classes for specific vocational education. Although industrial arts, manual arts, or the so-called prevocational courses, and strictly vocational classes do aim at entirely different objectives, nevertheless these are closely related in so far as a complete program for a democratic education is concerned. In fact, the success of vocational education partially depends upon the previous understanding, insight, and general acquaintance which the pupils have had with the

actual conditions and relationships in the industrial and commercial world. Of unquestionable importance is also the additional fact that the future wage-earner is a consumer as well as a producer; that a program for public education which neglects to help individuals to consume intelligently and utilize the hours of leisure wisely is decidedly undemocratic.

Experience has taught us that the instruction for those who are preparing for direct entrance into industrial pursuits or skilled trades, or are returning for trade extension work, should help them to acquire a high degree of manipulative skill or add to their technical efficiency. Recent reports from intermediate schools and junior-high schools on successfully tried units of industrial work, some of which will be given later in this publication, likewise show a generally accepted belief that adolescent pupils might well gain some knowledge of a reasonably wide range of typical industrial activities by having first-hand information and experience in important processes of manufacture, transportation, and commerce as a foundation for their life work. In the former case, the success of the individual depends largely upon skill and knowledge as these relate to quality and quantity production in some form. In the latter case, *the "self-finding" period demands appreciative insight into a sufficient number and variety of representative experiences to try out, discover, and*

develop ability for understanding and doing, as well as managing and supervising industrial work.

Current Tendencies in Seventh, Eighth, and Ninth Year Courses.

The junior-high school or intermediate-school *plan for selecting and organizing as large a variety of profitable experiences as possible and practicable is favored by over 123 of the 379 schools* which have recently reported from 21 different states on the industrial activities now being offered to their seventh, eighth, and ninth grade pupils. Table I shows that practically no changes are claimed in the purpose, work, and method of the industrial subjects in less than ten per cent of these so-called reorganized departments. However, these same data show that over 67 per cent of the 379 schools in question not only include notable changes in their upper grade curricula but also encourage the deferring of definite vocational choices as long as is possible. The majority of the school organizations which favor specialization in particular differentiated courses, either at the beginning or at the end of the first term in the seventh grade, are located in cities of over 200,000 population, indicating that the chief reason why nearly one-third of these schools now foster courses which are optional in name only, and actually impose early choices on the adolescent pupils, may be due to the administrative difficulty involved in the offering of a greater number and variety of activities to large numbers of pupils.

With two exceptions, all of the administrators who have commented on this situation state frankly that they are desirous of overcoming this apparent undemocratic practice just as soon as a satisfactory arrangement can be devised to meet the administrative problem of providing for all of the pupils.

In the 303 most progressive schools reporting on their main objectives, the equipment, the materials, and the technique in nearly all cases are chosen from important industrial pursuits, but with few exceptions, the recognized purpose of the work and study in these courses, as shown in Table II, is not primarily to produce skilled workers for definite vocations, as is true in the trade preparatory or trade continuation classes. The main objective is rather to help all pupils, regardless of their social status or possible lifework, to develop industrial intelligence and thinking power in connection with life situations. Therefore, each activity not only includes contact with typical materials, tools and machines, but also is organized with the intention of (1) giving broader appreciation of economic production and demanding more respect for the various workers and their work; (2) preparing for more intelligent judgment and use of industrial products and service; (3) helping to develop insight and to promote more efficient production; (4) offering opportunity for testing the interests and aptitudes of students, both in positive and nega-

Table I. Pertinent Facts Showing the Relation Between the Size of the Community and the Nature of the Industrial Work Offered.

Population of Cities	Schools Reported		Claiming Reorganization		Denying Reorganization		Nature of Work
	Number	Per cent	Number	Per cent	Number	Per cent	
5,000 to 10,000	76	20	49	13	27	7	Chiefly bench woodwork, or bench woodwork and drawing in over 97 per cent of these schools.
10,000 to 25,000	185	49	177	47	8	2	3 to 6 activities such as carpentry, concrete, electrical, printing, machine shop, pattern making, foundry, drafting, etc., in 93 per cent of cases.
25,000 to 200,000 and over	118	31	116	30.5	2	.5	6 to 16 activities and related studies in over 96 per cent of these schools.
Total	379	100	342	90.5	37	9.5	Over 75 per cent diversified to some extent.

Table II. Main Reason Given for Offering Industrial Activities and Related Studies in Each of 303 Intermediate and Junior-High Schools.

Chief Emphasis and Claims	Schools Number	Schools Per cent
Contributing to the general experience, all-round development, and industrial intelligence	118	39
1. Understanding and appreciating economic production in some form;		
2. Gaining respectful attitudes toward the various workers and their work;		
3. Having ability to judge industrial products and do simple repair and construction work, etc.		
Aiding in the intelligent selection of industrial occupations without encouraging early choices	101	33
1. Trying-out individual inclinations, interests, and capacities for industrial pursuits through typical experiences;		
2. Making reliable studies of the conditions, demands, and opportunities in related occupations; etc.		
Enriching the school experience of the pupils through concrete situations	78	26
1. Having science, mathematics, and other subjects, profit from a better understanding of materials, processes, tools and machines;		
2. Providing for the individual needs of pupils who would not remain for academic education alone.		
3. Helping pupils more wisely to choose future courses in secondary and higher education, etc.		
Preparing for entrance into industrial vocations	6	2
1. Extending the try-out activity to meet the preparatory-vocational needs of pupils who find it necessary to leave school with a minimum of preparation;		
2. Offering greater opportunities for commercial experiences in shopwork by cooperating with outside productive plants during the ninth year, etc.		

tive ways, in order that worthy needs and capacities may be developed through specific training. As shown by Table I, the size of the community too often determines the extent, nature, and effectiveness of the activities offered.

That the actual shopwork in a considerable number of these large and smaller secondary schools includes a fairly wide range of experiences is shown in Figure I. These are selected in the main from present-day occu-

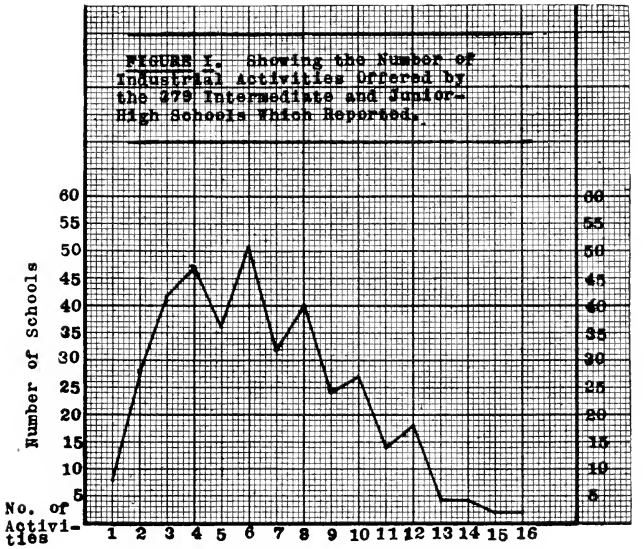


FIG. 1. INDUSTRIAL ACTIVITIES OFFERED IN 379 JUNIOR HIGH SCHOOLS.

pational pursuits, such as printing and publishing, carpentry, cabinet and furniture making, wood finishing, pattern making, foundry, forging, machine shop, sheet metal, concrete, photography, electrical, plumbing and pipefitting, automobile operation and repair, general construction and repair, drafting, and the like. Because of the advantage in having several kinds of materials, tools and machines available in one room for immediate use, and also because of the extended opportunity for observing many distinct types of construction work, composite workshop units frequently has been developed in preference to a number of separate, specialized shops, especially in the smaller communities. In either case, all projects and problems taken up in connection with each one of these activities preferably result in serviceable and useful products. As the occasion requires it, each project gives some consideration to the kinds and qualities of materials, the appropriate design and construction, the processes of manufacture, the applied mechanics, physical sciences, and mathematics, and the industrial history and civics as these relate to the study at hand.

Dr. F. G. Bonser of Teachers College, Columbia University, has referred to these promising courses happily as those "following the elementary school period, well adapted to the interests of boys during the period of early adolescence when more intensive studies

of industry will give a still greater opportunity for testing aptitudes, and develop greater intelligence and appreciation of industrial processes, problems, and relationships. The time for the beginning of this somewhat differentiated work for boys is probably at about the beginning of the seventh grade. The rapid development of the junior-high school or intermediate school bids fair to see such courses well organized for seventh, eighth, and ninth grades with from one-third to one-half of the time devoted to the study of industrial processes, shopwork, and closely related subjects for those who elect such courses, the remaining time applying to the usual general or academic subjects for these grades. By providing partial differentiation in these years, and at the same time keeping much work in common, the individual interests and aptitudes of children may be respected and developed, and yet the democratic character of the whole school maintained."[1]

Types of These Junior-High School Industrial-Arts Activities.

The following types of eighth grade industrial-arts courses, which first were inaugurated three years ago as a part of the junior-high school program at The Lincoln School, New York City, [2, 3] and incorporated the most successful and practicable features resulting from

[1]Bonser, F. G. "New Types of Industrial Work in Schools," Teachers College Record, May 1, 1915. Vol. XVI.

[2]These statements do not account for any changes which have taken place since October, 1920.

a careful study of over 300 progressive junior-high schools and intermediate schools in various parts of the country, are examples of the promising organized activities already described in some detail for either the large or small school system. A minimum requirement of three hours weekly during each of the seventh, eighth, and ninth years is found to be a reasonable amount of time for each of the essentially required industrial arts units offered.

Printing and Publishing.

(*Eighth Year.*)

Some freedom has been allowed all pupils in choosing projects to be printed. However each pupil is required to gain certain understanding and experience in composition, stone work, proof-reading and correcting, making-up forms, press work, distribution, and the other important processes typical of the job print shop. The thought-provoking problems, which are usually of a semi-commercial nature, are an outgrowth of the school or individual needs. These include such work as the printing of cards, programs, tickets, and straight matter at first; while later the artistic arrangement of headings, spaces, and lines is applied to the printing of

[3]*Note*—It might well be stated that the accepted policy of the whole junior-high school was then that "essentially required courses be given for the purpose of giving valuable contact with different types of world knowledge and with interesting and profitable activities; and that such courses serve as a basis for purposeful election of courses in the senior-high school; but that individual students be permitted to discontinue sequences of courses and substitute others, with the permission of their advisers."

announcements, forms, booklets, school publications, and the like.

This is followed by problems in color work and studies in modern illustrating. As the work progresses, the following types of information and skill are required sufficiently to give all pupils some appreciation of the methods and important conditions in our printing trades.

I. **Composition and Proof-reading:**
   1. Type case.
   2. Handling and setting type.
   3. Tools and materials.
   4. Setting and distributing straight matter.
   5. Printing terms.
   6. Setting and distributing display matter.
   7. Reading and marking proofs.
   8. Correcting type matter.
   9. Setting from manuscript.
   10. Expressing ideas in print in such a way as to attract attention, to stimulate thought, and, if possible, to produce action.

II. **Stone work:**
   1. Locking-up in the chase.

III. **Press work:**
   1. Making ready on the job press.
   2. Preparing paper and inks.
   3. Feeding the press.
   4. Study of presses.

IV. **Typography:**
   1. Types and type-faces.
   2. Proportions, harmony, tone, and contrast.
   3. Planning and layout of work.

V. **Studies related to printing and publishing:**

1. History of printing as it relates to present-day practice.
2. Making books and magazines (Harper Brothers).
3. Making newspapers (New York Times).
4. Relation of the school shop to the larger productive offices.
5. Conditions, requirements, and possibilities in printing and allied trades.

Machine Shop.

(Eighth Year.)

The possible machine-shop problems have consisted of machining castings and steel parts to be used in the construction of power machines, and also the doing of smaller problems such as arbors, washers, bolts, nuts, gear blanks, screws, bearings, bushings, pulleys, lathe centers, tool shanks, box caps, clamps, pipe threading and fitting, and various repair jobs as these are selected from the needs at the school and about the home. This wide range of work makes it possible for each pupil to have a reasonable amount of freedom in choosing projects and problems in the different divisions of the activity. Before the engine lathe or any other machine tool can be operated by the pupil without assistance, the importance of oiling the bearings, adjusting the machine parts for safety, fastening the work, choosing and setting the correct cutting tools, selecting the proper feeds and speeds, and taking the trial and finishing cuts must be thoroughly appreciated. During the eighth year the

following types of information and skill are acquired as a basis for understanding the processes and gaining insight into the metal trades:

I. **Lathe work:**
   1. Cylindrical turning on centers.
      a. Location and drilling of centers, grinding and setting of tool.
      b. Turning to definite size, using calipers, scale, and finer measuring instruments.
      c. Typical lathe operations.
   2. Taper turning.
      a. Calculating tapers.
      b. Method of turning.
      c. Finishing.
   3. Thread cutting.
      a. Calculating change of gears, etc.
      b. Grinding and setting treading tools.
      c. Cutting right and left hand threads.
   4. Chucking and boring.

II. **Drill press:**
   1. Methods of holding work.
   2. Various uses.

III. **Bench and floor work:**
   1. Chipping, sawing and filing.
   2. Laying out, fitting and assembling.
   3. Soldering.
   4. Use of taps and dies.
   5. Tempering and grinding tools.
   6. Key seating and fitting.
   7. Babbeting and scraping boxes, etc.

IV. **Related information:**
   1. Studies in elementary mechanics, mathematics, and short cuts as applied to practical shop problems.

2. Use, design, and construction of common and special hand and machine tools.
3. Methods of manufacture and commercial uses of iron and steel.
4. Relation of school experiences to organization and production in different machine shops.
5. Conditions, requirements, and possibilities in metal and allied trades.

Related Information as a Basis for Industrial Insight and Guidance.

It is now quite generally realized that *the most urgent need for the majority of boys from 12 to 15 years of age is not so much for a high degree of manipulative skill in trade operations as it is for reliable information with which to judge the industries.* Where the best results have been obtained, the exploratory shopwork plan has been paralleled by a study of real, productive industry rather than by a mere textbook acquaintance. There are but relatively few kinds of raw materials, and comparatively few principles involved in their manufacture. The number of great type industries and their important processes of production also are small to a surprising degree, which suggests that these studies should follow type activities and widely significant operations somewhat intensively. In addition to studies of general industrial conditions and relationships, group excursions to local plants and investigations of the various types of occupations as to importance, health conditions, needs, qualifications, wages,

opportunities, conditions of employment, and the like are helping to form sound judgments relative to the character and possibilities of industrial callings. As the occasion requires it, pupils are brought in touch with reliable reading matter, unbiased specialists, or whatever sources of information are most needed at the time. In some schools a simple but effective "vocational index" is used advantageously to record the inferences of teachers and others based upon activities carried on inside and outside of school, both during the attendance and follow-up periods.

While these diversified activities and occupational studies undoubtedly are beginning the preparation of life work for a large number, it certainly should not be assumed that all pupils who are taking industrial arts will go into the industries. If properly organized, a scheme of industrial-arts education should be liberal enough to help those who can continue their school work to choose wisely their more specific courses in secondary and higher education, and likewise help those who find it necessary to leave school with a minimum amount of education to choose their respective occupations most intelligently. Therefore, it is proving desirable to have the work and study include a large number of industries and industrial processes, in order that all may have a rich and varied experience upon which to draw, in any event.

Whenever vocational classes or cooperative courses exist, it often has proven more satisfactory to carry on as little as possible of the additional productive or highly specialized work in the "try-out" or "opportunity" shops of the intermediate school or the junior high school. At any rate, it is reported that a reasonable number of industrial plants are being visited, first-hand information of the proper type is being made available, and an attempt to make clear the existing relationship between the school activity and the industry represented is undertaken seriously in a comparatively large number of these schools.

Possibilities in Courses for Educational and Vocational Guidance.

Much of the criticism of the vocational guidance movement in this country may be attributed to the objection to having early decisions forced upon young persons by the larger experience of teachers and counselors. When reduced to its lowest terms, this conception of guidance merely concerns itself with placement, which consists of finding jobs or employment for pupils. Although teachers are certain to realize the need for giving counsel and information during the junior-high school period, and the very nature of their positions will cause them consciously or unconsciously to give much of both, nevertheless, the experienced teachers fully realize their limitations in this uncertain field

where many pitfalls are possible as a result of misdirection. On the other hand, *the great need for dealing intelligently with the problem of an efficient choice, both as to self-expression and public service, suggests that the decision might well come as a result of the pupil's understanding of economic facts and values.* Even though the school fails to keep its pupils from choosing blindly by presenting the related information and helping them to interpret this in terms of the existing conditions, the fact remains that sooner or later most secondary school pupils will choose their life work.

Several suggestive experiments have been developed to ascertain the benefits which may be derived from organizing separate courses in vocational and educational guidance as a definite part of the junior-high school program. One of these courses, which offers some promise, was introduced at The Lincoln School of Teachers College, New York, as an experiment in September, 1919. At that time, it was decided to devote one period of each week to provide all ninth grade pupils with reliable information concerning the social, economic, and larger personal aspects of the most important life occupations. This course was planned to help all pupils who continue their school work to choose their courses more wisely in the senior high school, as well as in their higher education, and also to help those who might find it necessary to leave school with a minimum amount of

education to choose their respective procedure more thoughtfully.

In connection with each possible life occupation studied, detailed considerations relative to the nature of the work, the advantages and disadvantages, the qualifications and training, the possibilities, remuneration, and advancement were had through reliable reading matter, class discussions, student reports, talks by specialists, and excursions. This organized information merely supplemented that which had been given in the other school activities by presenting all of the related facts that may help pupils to weigh values and choose their future courses and work. Aside from these vocational guidance values, this course also includes a brief interpretation of economic life, industrial ownership, labor problems, related organizations, scientific management, supply and demand, and the development of our present-day producing and service groups, in order to give understanding and to encourage a wholesome attitude toward work and workers in each occupation studied. Such important life callings as agriculture, fishing, mining, food manufacturing, textiles and clothing trades, mechanical pursuits, printing and publishing, professions and allied occupations, engineering professions, and commercial occupations were studied during the year with apparent interest and profit.

Problems in the Organization and Offering of Industrial Activities.

The junior-high schools in the large school systems usually have organized their industrial courses on the rotation plan by having separate, specialized shops to provide proper facilities and instruction for the various classes, each pupil of which elects from two to four different activities a year. In the latter case, each one of these unit courses is offered from five to seven and one-half hours a week during a period of either nine or ten weeks. On the other hand, the time allowed for the industrial arts in many of our upper grade curricula is still entirely too small for the manual aspects of the work and the studies of conditions and processes in the workaday world. Many of the small junior-high schools and intermediate schools also are hampered temporarily because of the necessary expense for suitable equipment and instruction. Nevertheless, more teachers in the smaller communities have had the courage to reorganize their courses on the general workshop plan already mentioned, thus adopting the all-around shop which is expanded easily from time to time.[4] This procedure makes it possible to include other typical industrial activities besides woodwork, which unquestionably offers somewhat limited possibilities for getting concrete experiences and studying present-day industries. In some of these schools, where only six different units of indus-

[4]Bowman, C. A. "Industrial Education for the Smaller Community," Manual Training Magazine, Jan., 1917, Vol. XVIII.

trial arts are provided, the length of time devoted to each unit course is extended to a semester, if the activity and related study in question can be justified for this time, and the length of the periods or the number of periods a week is reduced to meet the local situation.

In making this investigation it was found that the general aims of the industrial courses for seventh, eighth, and ninth year boys do not differ greatly as a result of the size and location of the school. On the other hand, the organization of each respective department has been determined necessarily by the size of both the community and the school, as a number of instructors and several distinct shops are used to accommodate large numbers of pupils while only one man or perhaps two men will be available to teach industrial arts in the smaller school. The original try-out courses taught in the Washington Junior-High School at Rochester, New York, are examples of the former type, having a separate shop and instructor for nearly every particular form of industrial activity offered. This type of organization allowed the boys to have samplings of at least ten weeks from each of the different shops during the course. Printing, cabinet-making, gas engine, sheet metal, pattern making, and machine work were each offered for ten weeks, however, this did not mean the same total number of hours in each shop. Printing and cabinet-making were offered during the last half

of the seventh year, when only six hours a week were allowed for shopwork, while twelve hours a week were given in the eighth year to gas engine, sheet metal, pattern making, and machine work respectively. During the ninth year twelve hours a week were provided for shop work and, since this was the last year of the try-out period, each boy was allowed to choose one or more activities from cabinet-making, finishing, printing, machine shop, pattern making, sheet metal, gas engine, painting and decorating, plumbing, electricity, and baking. Related industrial mathematics, elementary science, and drawing and design were required throughout the two and one-half years of the course; seven and one-half hours a week being allowed for mathematics and drawing, while one-fourth as much time was spent on elementary science as on shopwork.

It is important to note that the various kinds of industrial activities offered in the Rochester junior-high schools are typical of important industries represented in Rochester, New York. In addition to the modified try-out course, each school now offers separate industrial technical and vocational courses. Perhaps it should be mentioned that the Rochester Trade School, which is likewise a part of the city school system, is prepared to give even more definite vocational education to those desirous of preparing for specific industrial pursuits or trades. This school has trade agreements with many of the leading shops and factories in that city.

Modifications of this plan for the rotation of shop work are being practiced more or less effectively in Duluth, Minnesota, in New York City, in Detroit and Grand Rapids, Michigan, and other cities. The shop work at the Ben Blewett Junior-High School in St. Louis, Missouri, is organized into two divisions: First, the seventh grade, which has compulsory activities and, second, the eighth and ninth grades, which have elective shop courses. In other words, each pupil has an opportunity to choose between the technical arts, science, commercial, art, and classical courses after completing the essentially required industrial-arts work during his seventh year. More detailed statements of these courses, as well as reports on several units, projects, and problems which have been successfully developed by individuals having somewhat varied points of view and results, appear in the following chapters.

Improved Methods Needed in Many Industrial-Arts Courses.[5]

In spite of the excellent results and promising outlook which have been reviewed, this investigation makes it evident that traditional practice still too largely determines the content and method of the industrial subjects in the seventh, eighth, and ninth grades. The following facts, which are based on this survey relating to the

[5]Edgerton, A. H. "Experimental Work in Junior-High School Industrial-Arts." Industrial-Arts Magazine, July, 1919, Vol. VIII. (See also for Tentative Course of Study.)

instruction received by 7,389 pupils in different sections of the country, show that large numbers of these courses include features which are extremely wasteful and consequently omit much that is useful. While a few of these school systems have introduced the junior-high school plan of organization in name only, as previously suggested, it is reasonable to believe that the methods and procedure for the industrial courses in these 379 selected schools are, at least, equal to the instruction ordinarily received in other schools having similar aims and purposes.

I. *Over 20 per cent of these schools report that the shopwork in their courses is confined to work in wood only.* (See Table I.)

Even though this work properly represents the divisions of the woodworking industry (carpentry, pattern-making, and the like), and is supplemented by studies of occupations through shop excursions and readings, it at best offers limited opportunity for gaining typical experiences and studying our present industrial pursuits and needs. It is doubtful if those courses which mainly tend to emphasize manipulative skill in the use of woodworking tools can be expected to do more than to gain meager responses in interests, inclinations, and capacities, for reasons which will follow.

II. *Over 78 per cent of these schools report that their courses emphasize the doing of many operations or*

processes without respect for the needs and interests of their pupils.

Several of these courses allow the pupils to make worth while products, thus allowing the manipulative skill to be incidental to the solution of the construction problems, but completely fail to allow an opportunity for thinking out and making plans to meet the difficulties involved in their work. The majority of these pupils are required to do their work in a certain prescribed way, as the chief emphasis is placed upon the following of directions, and very little allowance is made for initiative. A number of the instructors of these classes report that they are encouraged to do much of the pupils' work for them, since the success of their courses is frequently judged in terms of the quantity and quality of work which is displayed at the annual school exhibition. The least successful of these courses, however, are those which require all pupils to make formal exercises, models, or pieces that give considerable skill in the use of tools but offer little else of value. Nearly 60 per cent of the instructors admit that the repair and construction work which they are required to do for the school systems forces them to emphasize the production work needed rather than the specific needs and interests of the learners.

Perhaps there is greater danger of exploiting pupils in industrial courses than in any of the other school sub-

jects. This is explained by the insistence of some administrators and teachers upon having all maintenance work, such as repairing and making furniture and other school equipment, printing school forms, and the like, done during the regular shop periods, regardless of whether or not the pupils concerned are benefitted by the particular kind and amount of experience involved in the work which they are required to do. Where the doing of the work is given this undue amount of emphasis, one cannot help wondering if those responsible for this procedure are not more concerned with the repair and construction work than with the educational growth of their pupils. At any rate, some such method as the following must be developed for overcoming this extremely bad feature of tending to make the school shops a sort of "dumping ground" by selecting experiences which obviously have meager educational value during regular school hours.

An *employment bureau plan,* which was introduced three years ago at The Lincoln School, New York City, affords several unique educational advantages by assisting the older pupils in finding interesting and instructive employment about the school during out-of-class hours. Pupils from all classes of homes are given an opportunity to do certain parts of the school's work, such as printing school forms and announcements, checking and receiving pay in the lunchroom, assisting in the library or classroom, and repairing and construct-

Job Card.

Date.....

Nature of work .....

To be made for .....

Date promised ....Extension .....

Date delivered .....

Pupil's name .....

FIG. II. JOB CARD.

ing school equipment. This work in each case is arranged and recorded by the pupil in duplicate form on the job card shown in Figure II, after which it is carried out under the supervision of the teacher in charge of the respective activity. The amount of money which pupils are paid for the different kinds of unskilled, semi-skilled, and more highly skilled or responsible work ranges from ten cents to twenty-two cents an hour; however, the rate allowed in each case is determined by the nature of the work at hand and the ability of the pupil chosen to do it. Although the pupils are free to give only a few hours a week to this special activity, all of the junior-high school pupils participate in at least one or more of these profitable experiences during the year.

In addition to the financial consideration, this employment bureau plan gives pupils a better appreciation of actual service, and offers valuable experience in learn-

ing to earn, without danger of exploitation. The various tasks not only furnish an excellent substitute for the responsible duties which children have in the rural communities, but also make it possible for boys and girls to use their special interests and abilities beyond the stages when the work can be justified as a legitimate part of the regular class activities. This type of employment organization represents a relatively small investment and is not considered a financial burden in any sense. It provides a satisfactory means for disposing of certain necessary jobs which offer somewhat limited educational value during regular school hours, and it likewise allows the industrial-arts courses to emphasize the needs of the learner in preference to the needed repair and production work which should have a place.

Regardless of the size of the school system, if the industrial-arts activities are to continue to occupy an important place in the program for general education, these courses must be expected to share the responsibility with the other subjects for helping adolescent boys to develop perspective and thinking power in connection with real life situations. These investigations clearly show that such larger values as industrial intelligence and insight can not be realized alone from the mere doing and making of things, where skill in the manipulation of materials, tools and machines is the

main emphasis. Furthermore, *the psychological and sociological needs and interests of boys from 12 to 15 years of age are mainly in thought-provoking situations, projects, or problems, involving semi-productive or real production work,* rather than in series of exercises, models, pieces, or whatever else you may care to call them. Because of the natural interest which boys of this age have in industrial or mechanical things, they can be required to make series of formal pieces, models, or exercises without much resistance; however, to thus take a considerable amount of time in *over-emphasizing skill in the use of a few tools and materials* means a great sacrifice in the larger values of the work, as already stated. The results of much observation and several experiments make it obvious that any values which exist in such formal courses may be retained and given greater emphasis where the boys' chief concern is the construction and solution of useful projects. The most valuable of these challenge boys to think out, study, and make definite plans to meet the difficulties involved in the related problems, as well as to select proper materials, tools, and operations; to make calculations on stock, operations and cost when needed; and to carry out the other requirements which the specifications demand.

II. Organizing and Conducting Representative Activities

Improvements Result from Clear-Cut Objectives

ANY promising results and a few striking inadequacies have been pointed out in connection with recent investigations of the seventh, eighth, and ninth grade industrial activities in 379 of the most progressive intermediate and junior-high schools in the United States. In studying these data, one is impressed by the marked improvements in content and method which have been realized during the past five years. Undoubetdly this progress is due partially to our greater tendency to insist upon having courses of study in industrial education programs based upon clear-cut needs and objectives. In judging the worth of *what* and *how* we teach in the shop and other related courses, both administrators and teachers have found it advantageous to distinguish more clearly between the aims and purposes of those courses which have more or less indirect vocational significance, but are offered mainly for general educational ends, and those units which point directly to a means of preparation for wage-earning occupations. However, there still is a wide difference of opinion with respect to the most suitable methods for organizing and offering the former courses,

especially with the thought of having seventh, eighth and ninth year boys learn most effectively and economically.

Chief Reasons for Offering Try-Out Courses.

In some respects, the various claims for the industrial arts courses might be considered as hopeful expressions of ideals rather than as representing the present status and conduct of this work. This is one more indication of the progressive spirit which is backing the movement in this country for democratic ideals in our public school systems. Notwithstanding the similarity noted in the chief claims, which after all differ largely as to the amount of emphasis given to each item, the achievements observed in a number of schools make it evident that a decided difference exists both in the conception of the claims themselves, and also as to how these can be realized most satisfactorily.

In the reports from 303 schools, each of which gave its main reason for offering instruction in the industrial arts and related studies, the four leading claims, when collated, were found to be given the following order of importance:[6]

1. Contributing to the general experience, all-around development, and industrial intelligence.

[6]See Table II in the introductory chapter for number and per cent of schools which emphasized each item.

2. Aiding in the intelligent selection of industrial occupations without encouraging early choices.

3. Enriching the school experience of the pupil through concrete situations.

4. Preparing for entrance into industrial vocations in the school and through cooperation outside.

It is obvious that these claims give little clue to the actual content and method of the courses which they represent.

Determining the Important Need for Courses.

Although over 80 per cent of the 379 schools investigated state that their industrial activities aim (1) *to develop the pupil's special aptitudes and capacities* and (2) *to prepare him for the demands which the future is going to make upon him,* there is a decided range of opinion as to how these objectives are to be accomplished. Many of the school authorities seriously believe that the success of the industrial arts instruction depends upon the extent to which the work is organized and offered in approximation of the processes, problems, and conditions in the divisions of industry represented.

It is encouraging to observe that *over 67 per cent of these intermediate and junior-high schools are attempting to broaden and vitalize the industrial activities which heretofore have consisted mainly of shop work* (often limited to benchwork in wood). The jun-

ior-high schools of Los Angeles, California, offer a good illustration of this change which has taken place in many systems during the past two or three years. In this case, the shop courses, which formerly covered three years of woodwork, have been reorganized to give pupils so-called vocational exposure, along with the study of occupations for the purpose of enabling them to enter their life work with some vision of the vocations. Experience already has shown that the industrial arts or prevocational courses are an incentive for causing pupils to enter the senior-high school, in which case they are prepared to elect vocational or other courses more intelligently, and to make progress from the outset.

Industrial Work as a Functional Activity.

Because it is impossible to represent all of the various recognized wage-earning occupations in the local community, a small number of the schools have concluded for the present, at least, to consider the industrial work more as an intellectual or liberal study than as a functional activity. The shopwork observed in several of these schools resembles the earlier form of manual training, which was introduced at that time as a mental discipline rather than as a practical subject. As a result, such courses are so formal and isolated that they apparently fail to connect up with the practical applications of everyday life. Even the technique, which is emphasized in making different abstract pieces and

exercises, does little to inculcate habits of productive industry, thrift, and service as is occasionally claimed.

It unquestionably would be both impracticable and undesirable for any school to fully represent so great a variety and number of highly specialized occupational pursuits, as are listed for any of our cities of mixed industries in the last Special Report of the United States Census. The expenditure could be justified neither on the basis of vocational efficiency nor because of educational needs. An investigation which was conducted a few years ago by Dr. L. P. Ayres, of the Russell Sage Foundation, in order to ascertain the facts concerning the conditions in 78 American city school systems, has some bearing on this claim that the intermediate or junior-high school should participate in a program for industrial education "that will directly prepare the children to enter the local industries." The facts regarding the birthplace of the 13-year old boys in the public schools of those cities, which were between 25,000 and 200,000 population, show that "only one father in six was born in the city where he now lives and only a few more than one-half of the boys were born where they now live."[7] Table III shows the detailed facts of the 22,027 cases studied by Dr. Ayres.

On the other hand, experience of the past few years has demonstrated clearly that it is possible to offer well-

[7]Ayres, L. P. "Some Conditions Affecting Problems of Industrial Education in 78 American School Systems." Russell Sage Foundation Publication.

organized units of typical activities, which will develop varying degrees of industrial intelligence and give insight into the conditions, in a number of modern industries without the danger of over-emphasizing the limitations in localized and undesirable occupations. This does not mean that we should be unmindful of the *local*

Table III. Facts Concerning Birthplace of 22,027 Boys and Their Fathers Indicate that Large Majority of Adults Will Not Work in Same Communities Where Schooling is Received.

	Boys		Fathers	
Birthplace	Number	Per Cent	Number	Per Cent
Same City	12,699	58	3,601	16
Same state but not same city	4,233	19	5,349	24
Other states in United States	3,069	14	4,364	20
Foreign country	2,026	9	8,713	40
Total	22,027	100	22,027	100

needs and interests in representing and organizing industrial-arts courses for any community. The local well-being of the home and community in an agricultural section, for example, demands a somewhat different emphasis in its industrial work than would be offered to meet the needs in a city of mixed industries.

Wide Range in Content of Industrial Courses.

Rural industrial work, which mainly concerns itself with farm projects that are carried on inside and outside of the school shop, represents one type of local

interest for helping to determine the content and method in several of the schools reporting. With few exceptions, the essentially rural communities state that notable progress has been made by abandoning the absurd practice of basing their procedure largely upon the courses and methods of the larger school systems. For obvious reasons, the all-around or farm-workshop plan, already described as a solution for the industrial arts in the smaller community, likewise is found most suitable for the limitations of these rural intermediate and junior-high schools.[8]

Such closely related activities as carpentry, concrete construction, harness repair, forging, bench metal work, gas engine operation, machine assembly and repair, farm woodwork, and the like are taught by the local instructor, who frequently extends the opportunity for concrete experiences and information by cooperating with practical men and establishments in the community. It is evident that the needs in any one of these activities call for a diversity of dexterity and knowledge for understanding, for constructing, for improvising and for repairing products to be used on the farm and in the home. The needs in farm woodwork, for instance, are not so much for products involving carefully made, close fitting joints as they are for such comparatively rough but useful construction as potato

[8]Roehl, L. M. "A Farm Workshop," INDUSTRIAL-ARTS MAGAZINE, Nov., 1915, Vol. IV.

crates, gates, brooders, hen-coops, cold frames, seed testers, corn-cribs, garages, eveners, single-trees and various rebuilding and repair jobs. The schools which stress the home needs as a part of the farm-mechanics courses often include the renewal and repair of such utilities as faucets, window and door screens, plumbing, electrical fixtures and appliances, the adjustment of window shades, door locks, lawn mowers, doors that bind; also, the making of the many other adaptations which must necessarily be met in rural communities. When properly offered in terms of the school and home projects, the industrial activities and related studies furnish excellent possibilities for unifying the school, the farm and the home life of all concerned.

Industrial-arts courses in cities of mixed industries are being organized, more and more, to include different types of representative experiences chosen from present-day industrial callings. Beginning in the seventh grade, boys in many cities of over 10,000 population are given short courses in a number of shop units as a try-out, or so-called prevocational, period. This system frequently gives both the pupils and teachers some basis for the future selection of courses and occupations. Some of the schools insist that they are extending these opportunities in order to give special preparation for entrance into the skilled trades. For example, the Hackley Manual Training School, at Muske-

gon, Mich., allows its pupils to elect vocational or trade school courses at the end of the seventh year, if circumstances make it impossible or undesirable for boys to continue through the regular high school. Perhaps the former courses in the Lafayette Bloom Junior-High School, at Cincinnati, O., give one of the best illustrations of a department which primarily aims to offer an earlier beginning in specific training for those boys who leave school without much further preparation. These courses are the exception, however, as a large majority of the schools report that they are making no special attempt to emphasize proficiency in specific occupations as low as the seventh and eighth grades, because of their conviction that the industries offer little to boys under 16 years of age. Nevertheless, a comparatively large number of schools in this group insist that boys can be given enough freedom in choice and sufficient variety of industrial experiences to help many in the selection of their life work and some in the beginning of their preparation for it.

The most progressive of these industrial-arts courses, which are designed, in part, to try out interests in order to determine likes and dislikes, and to test capacities for understanding and doing industrial and mechanical work, do tend to contribute toward the greater vocational efficiency of the pupils during the ninth grade. This would seem to be the psychological and

physiological time to place somewhat greater emphasis upon technique and the related technical information. As a result of the various try-out experiences in the seventh and eighth years, some pupils are found taking more extensive work in courses already started, while others investigate new activities or experiment with selected problems. This practice is also increasing in those schools which take the attitude that while a number of the boys will not be adapted to industrial work, either in interest or ability, all boys should have an intelligent understanding of the processes, conditions, and relationships in productive industry.

General Methods in Organizing Try-Out Courses.

In the best of these courses, each pupil participates in a reasonable amount of work which stresses the atmosphere and, to some extent, the time element and accuracy of the commercial plant.[9] Whenever the equipment in the school shop, for example, will not allow boys to do their work by the most practical methods, it is made clear how this would be taken up in the commercial shop and that their work is being carried on in as practicable a manner as possible with the necessarily limited shop facilities. This and other information, relative to the methods used in larger productive industries, is gained through such sources as planned excursions, reliable reading matter, student reports,

[9]Edgerton, A. H. "To What Extent Can We Justify the Use of Machinery in Our School Shops on the Basis of Its Efficiency?" INDUSTRIAL-ARTS MAGAZINE, Nov., 1915, Vol. IV, p. 202.

motion pictures, class discussions and talks by specialists.

As would be expected, there is some variation both in the kinds and in the organization of shop activities represented in the various school systems. The Ettinger plan, in New York City, for example, provides for the rotation of a combination of nine-week units in designated intermediate schools, where the boys get experience in machine work, sheet metal, printing, wood working, electric wiring, plumbing, drafting, garment design, sign painting, and bookbinding. This plan is so organized that a boy who has unusual ability may receive special training without completing the cycle.

The junior-high school, at Grand Rapids, Mich., also rotates the boys in printing, sheet metal work, automobile construction, wood working, machine shop practice, electrical construction, forging, and mechanical drawing for one double period daily. This school undertakes to have each boy sample the eight activities for ten-week periods during the seventh and eighth years, in order that he may continue one elected activity more intensively for the entire year.

At School No. 47, Buffalo, N. Y., the industrial activities include machine shop practice, forging, sheet metal work, pipe fitting (for the seventh grade), bench woodwork, plaster casts, wood turning, pattern making and molding, electrical work (for the eighth grade),

carpentry, cabinet making, wood finishing, pattern making and foundry work, concrete construction (for the ninth grade), and mechanical drawing (for all grades). The boys in this school spend three hours or one-half of the school day in these try-out courses.

There is an attempt to separate the try-out and technical activities from the so-called vocational work in the Washington Junior-High School, at Rochester, N. Y. As will be explained in more detail later, the printing, millwork, pattern making, sheet metal work, painting and decorating, and mechanical drawing facilities are used in common for both types of courses during separate periods, while the cabinet making, machine, electrical, and automobile shops are reserved especially for either purpose.

The Thirtieth Street Junior-High School, at Los Angeles, California, which has already been referred to in this chapter, is organizing its activities "so that there will be little woodwork in the seventh and eighth grades." This school has organized its widely varied try-out courses in the seventh year "to consist of ten weeks of agriculture, ten weeks of mechanical drawing, ten weeks of typewriting, and ten weeks of printing. These courses are to be followed in the eighth year by ten weeks of sheet metal, ten weeks of electrical work, ten weeks of concrete work, and ten weeks of plumbing. It is the intention to have the ninth year courses so

organized that the work of the previous grades may be worked out into vocational classes for the higher grades." Regarding the content of these industrial-arts activities, Assistant Supt. Helen S. Watson reports as follows: "In all of this work, the emphasis is placed upon the practical side. In the Boyle Heights Junior-High School, for example, all repairs of school furniture and locks; making of keys; construction of shelving, cupboards and tables are done by the regular classes. Concrete workers have built retaining walls and repaired walks, and are now constructing a pit in the machine room for the installation of motor and shafting. A lath house, including the installation of plumbing and the building of a fence, is now being made for the agricultural department. It is understood that at least one-half of the time of the older boys may be spent on work for the school."

How Industrial-Arts Activities Are Conducted.

The amount of emphasis which is given to each element in these and other try-out courses shows even greater variation than has been noted in the activities themselves. However, a great majority of the least hampered intermediate and junior-high schools —231 or 61 per cent of those which reported—have organized their industrial-arts courses so that *each concrete experience brings boys in contact with information on some phase of the conditions and processes encount-*

ered in present-day industry and occupations, as well as with the materials, tools and methods of manipulation in the activities represented at the school. Regardless of the nature of the project, problem, or job-- whether it happened to be a division of concrete construction carpentry, electrical work, printing, machine shop, drafting, or any other industrial pursuit--each boy in these courses gives little or much time (approximately from 5 to 35 per cent of the total time allowed) to such types of closely-related information as the kinds and properties of material used; the particular form of design and construction needed; the methods of manufacture practiced outside; and the principles and facts affecting the conditions and relationships under which workers work. Nearly all of the manual experiences, which naturally are made the basis of opportunity for giving this *information to extend the boy's industrial horizon,* result in useful and semi-commercial products and service.

Basis of Semi-Commercial Work.

The greater part of this semi-commercial work (estimated as high as 95 per cent in some schools) is based upon the construction and repairs needed in the school systems. Only a few of the schools feel free to state that the requirements of repair or productive work in their systems are considered second in importance to the pupils' needs beyond these immediate experiences.

Furthermore, over two-thirds of the instructors, in the 231 institutions mentioned above, admit that they can not justify the time and effort required for a large proportion of this construction and repair work, especially when they are ordered to deliver the products within a limited time. The reasons which were given most frequently by 157 individuals for their dissatisfaction with the over-emphasis and unregulated demands of the school system upon repair and maintenance construction work, are summarized in Table IV. It should be noted that the main objections are to the effect of limiting the industrial experiences to the manual aspects of the work; namely, preventing the instruction from including a larger understanding of the processes and conditions in the industries represented, by failure to regulate these valuable experiences in order that the pupils' needs and interests might receive first consideration.

Nevertheless, increasing numbers of schools are adding other concrete experiences besides those which tend to furnish the largest financial return in materially reducing the annual budget for repairs and production work. These new industrial-arts activities seem to be allowing a larger percentage of time for the study of those methods, conditions, and relationships that are involved in the divisions of industry which the school experiences represent. Although boys of this age are interested primarily in the various phases of the direct

Table IV. Each of 157 Individuals Gives Reasons for Dissatisfaction With Continuous Demands Upon Industrial-Arts Activities for Repair and Productive Work.[1]

ITEM—	NO.
Unregulated requirements limit the amount of instruction given to:	
1. Technical information for enlarging the understanding of tools, materials, operations, and principles directly related to the shopwork.	37
2. Vocational information for illuminating the school experiences by giving insight into commercial processes and methods employed in economic production.	28
3. Occupational information for helping to appreciate and judge labor conditions, importance of work, health problems, future opportunities, qualifications and training	21
Narrow limitations in maintenance needs of schools tend to:	
1. Prevent representation of proper forms of industrial experiences to meet various needs of pupils	32
2. Require instructors to do much of the planning and construction work for pupils	17
3. Cause difficult operations to frequently precede the simpler ones	8
Extended repetition of same operations and processes seem to:	
1. Give too highly specialized skill for boys of this age	14
2. Cause adolescent boys to lose interest in work with little variation	11
3. Limit scope of acquaintance with typical tools, machines, materials, and processes of manipulation	7

[1]These numbers will total more than 157, as several individuals reported more than one reason.

manual experience, more and more instructors have come to recognize the need for vitalizing the manipulative aspects of the activities by introducing thought-provoking situations. Both projects and problems in these courses include a *breadth of instruction* which stimulates thought for better understanding, insight, and appreciation. A few representative types of the directly and indirectly related information, which boys acquire profitably as they plan and construct products having commercial value, are listed in the first section of Table IV.

Conducting Representative Industrial Courses.

It should be explained that the following reports dealing with three widely varied types of successfully organized industrial arts courses at Hastings, New York, at St. Louis, Missouri, and at Rochester, New York, (as well as the several carefully planned and tried courses, units, and projects which are to appear in the next and last chapter of this book) were collected for the 1921 Yearbook by the Industrial Arts Committee[13] of the National Society for the Study of Education. Since it did not prove expedient for the Society to publish Part III of its 1921 Yearbook, which was to have included these suggestive contributions, it has been recommended and urged that, if necessary, this report on experiments for developing in-

[13]The Committee appointed to collect these successfully tried units was composed of L. A. Herr, G. H. Hargitt, and A. H. Edgerton, Chairman.

dustrial courses and projects to meet the needs of early adolescence should be revised for publication.

Types of Industrial Arts Conducted in Smaller Communities—An Illustration.

Diversified Industrial Activities at Hastings, N. Y.[10] In the *seventh grade* at Hastings, N. Y., concrete construction is taken up as the main activity. Brief talks are given on the manufacture of cement early in the course. This naturally follows the story from the rough rock to the finished products, as developed in the shop. The forms for the simple concrete products involving mass construction are made from wood by the pupils. Some of the boys work individually on problems needed for the home, while others work in groups on larger projects, many of which are made for the school.

Running along parallel with the construction work, short talks also are given on the proper methods of preparing the forms for concrete, the kind of lumber to use, etc. The ingredients required to make concrete, their selection for desired mixtures, and methods of testing likewise are taken up and followed by the actual proportioning of materials, mixing, placing, depositing, and protecting. After having completed projects in mass construction, reinforced and hollow construction problems are attempted. It has been the aim

[10]Contributed by Wm. H. Peters, Head of Industrial Arts Department, Hastings, N. Y.

to have this work in the school shop of the same nature as the smaller construction work in the industry; but, as this is not possible in all cases with a small amount of equipment, trips are made occasionally to places where concrete construction is in operation. Notes are taken on the practical ways of doing this work on a larger scale.

In the *eighth grade* at this school, sheet metal work is introduced. Starting with the making of a simple biscuit cutter from a discarded soup can, the boys learn the principles of soldering. They have the experience of cutting and folding tin and soon become familiar with the metal working tools. A cup is then made, and the method of making a flange, or turning the edge, is explained. Coffee pots or watering cans have been found to be good problems for bringing in riveting. The making of spouts affords splendid opportunity for planning developments, as does the making of a funnel. Then after making a frying pan with a rolled edge from a round gallon can; each boy selects his projects and shows no end of interest in making up such problems as match boxes, lanterns, dust pans, stationery boxes, ash trays, and such toys as automobile trucks, tractors, steam rollers, locomotives, and boats. Figure III shows a few of these sheet metal problems.

The material for this work during the past year has consisted mostly of discarded tin cans. Several

thousand of these have been brought in by the boys. Aside from the pleasure and knowledge derived from the actual making of the tin products, perhaps the greatest satisfaction lies in the fact that the boys are

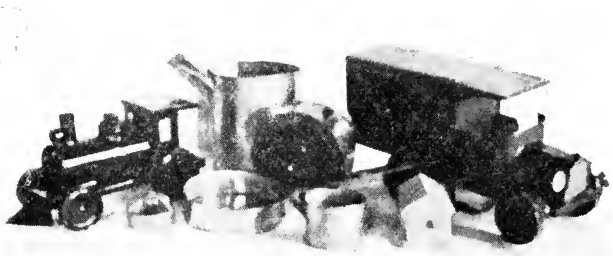


FIG. III. A FEW OF THE SHEET METAL PROBLEMS WHICH .. WERE ELECTED AND DEVELOPED DURING THE LATTER PART OF THE COURSE.

using materials which usually are thrown away. You might say that this is making "something out of nothing", thus eliminating bills which would otherwise be incurred. In this work the boys use their own initiative after being shown the simplest principles. Fig. IV shows a boy making bathroom fixtures for a doll-house. The combination of simplicity with the chance to use creative ability has proved of untold value. There was such a great amount of interest taken in this kind of work by the boys that many have asked to do extra work. As a result, many ingenious projects,

some of which required a knowledge of mechanics, have been worked up.

In the *ninth grade* course electricity is introduced. Sets of apparatus are made here in order to cover the

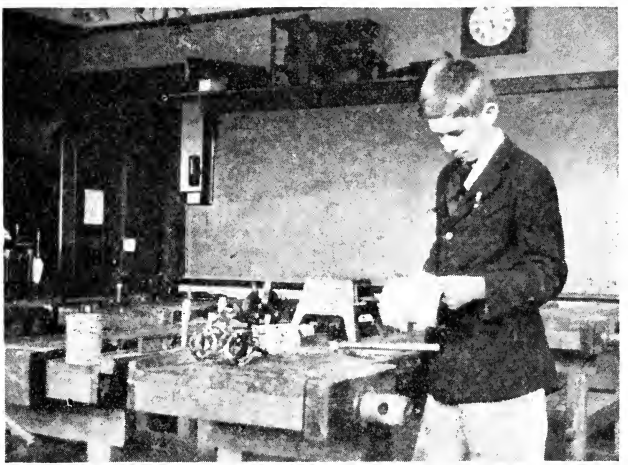


FIG. IV. EIGHTH GRADE BOY AT HASTINGS, NEW YORK, MAKING BATHROOM FIXTURES FOR A DOLL HOUSE PROJECT IN THE SHEET METAL CLASS.

important principles of electricity. The constructions are kept as simple as possible in order that the theory given in talks, which parallel the shopwork, may be clear. As a first project, a simple telegraph sounder is made from a scrap of wood for a base, two twenty penny nails for the core of the magnet, a piece of tin

(from an old tin can), which is folded and shaped for the armature. The key and switch are made from scrap pieces of tin and wood. When two boys have completed these instruments, they can get great interest in setting them up to form a complete telegraph system between two rooms. Next a buzzer is made of as simple construction as the sounder already described. This is followed by the making of a push button, which is as easily constructed as the key mentioned above.

Later a toy motor is introduced with good results. The experience of adjusting and hunting electrical trouble in this problem affords enough incentive to guide boys through the principles of the motor. After completing these problems, they select and make projects which are of particular interest to them. Many ingenious instruments have been turned out in the form of shocking coils, burglar alarm, wireless sets, etc. The boys seem to take a great interest in these problems, as well as in working out different experiments on an electro board which contains a number of possible hook-ups.

TYPES OF JUNIOR-HIGH SCHOOL INDUSTRIAL ACTIVITIES IN LARGE SYSTEMS.

Seventh Grade Industrial Arts at the Ben Blewett Junior-High School, St. Louis, Mo.[11]

The shopwork at the Ben Blewett Junior-High

[11]Contributed by G. H. Hargitt, in charge of industrial-arts Classes at St. Louis, Mo.

School in St. Louis, Mo., is organized into two divisions: First, the seventh grade which has compulsory shop courses, and the eighth and ninth grades which are elective. After a boy has taken a year in the elementary shop, he then has an opportunity to choose between the technical arts, science, commercial, art, and classical courses. This report will, therefore, only discuss the *seventh grade shopwork and study.*

This community, which is entirely residential and draws from a class of students whose parents, to a large extent, will encourage higher education, presents a problem which is quite different and difficult. Most of these children live in apartment houses, where they are deprived of the privileges of tinkering and experimenting in shops of their own. It is believed that all boys want or should have this experience, so for this reason, we are giving them this one big chance of their school career for guided experimenting.

We try to make a cycle of the material with which they work, as much as possible, by encouraging that they first of all use wood as their medium of construction. This is followed by the use of sheet metal and soldering. Casting of soft metal in die-casting molds follows this, and finally they work in concrete and in electricity. We hope to have each and every boy come in contact with all of these different media of construction some time during his work in the seventh grade

The pupil, too, has the actual shop experience, with the added responsibilities of having complete charge of the issuance of tools in the tool room by means of a check system. He is made to feel that he is responsible for the tools and that he should see that they come back to the tool racks in as good condition as when they were given out. These are just further steps of the aim for making the boy feel that he is a part of the governing body, as well as the one to be subject to rule and order.

Wherever possible, it is the endeavor to have the work so arranged that the boys make use of their projects to help them pass their merit badge tests for the scout organizations and for clubs. All of these things solicit the closer cooperation of boys by making them feel that there is a connection between all of these activities. A few excellent projects of this type are the chemistry sets, the heliograph, the telegraph set, the wireless, the naturalist's box, the level, and the chart board, having the compass for charting the hikes made by the club.

Another project, which proved its worth last spring, was the organization of a Yacht Club previous to the races between the Shamrock and the Resolute. We studied the merits of the many types of sailing craft with reference to speed and ability to weather a storm. The boys became so enthused that they even

conducted a few races among themselves and then discussed the merits and faults of the various boats.

The organizing of a Railroad Club, which ran through the whole of last year, was the most successful of our projects, not so much from the skill and technique of the project as from the vast amount of information and satisfaction which the boys derived. We elected the officers of the Railroad Corporation with its executive board, and this in turn had its subdivisions. There was a superintendent of road construction; a superintendent of block signals; one of the construction of cars; one for the engines; and one for the bridges. They met and decided on the scale upon which to build the model railroad. A scale of one-half inch to the foot was agreed upon. They then proceeded to choose the helpers and assistants from the remainder of the club members and began on the development of the drawings and plans. A book of plans and specifications, published by the Railroad Builders' Supply Companies, was procured and used as a guide. The boys made several trips to the railroad yards, switches, bridges, and signaling towers. After watching the different operations of the parts in which they were interested, they brought information to the club which aided them in the construction of their projects. The benefits derived from these studies were not local entirely, as the boys in their enthusiasm solicited the

interest and curiosity of the parents to the extent that many of them visited the meetings of the club and contributed of their knowledge and skill to aid in the construction of the main project.

Industrial Department of the Washington Junior-High School, Rochester, N. Y.[12]

At Rochester, N. Y., the Washington Junior-High School gives three types of industrial courses, which are called general try-out, industrial technical, and vocational. The *general try-out course* is for boys in the 7A grade, since a general requirement in this grade is that every boy shall have one period of shopwork a day. The aim of this work is to give the boy a general idea of what industrial work is like, so that he will be able to make a more intelligent choice of his course when he enters the 8B grade. The *industrial technical course* fulfills a double purpose. It is both a prevocational training period and a general industrial information course. This course is elective for boys in the 8B grade or above, and it differs from the regular academic "foreign language" course only in the fact that one period a day of shopwork is substituted for the foreign language. The boys spend one term in a certain shop and then change to a different shop for the next term, so that at graduation from the Junior-High

[12]Contributed by R. Parkhill, vocational coordinator, Rochester, N. Y.

School they have a definite knowledge of at least five different kinds of industrial work. This course is preparatory for the regular high school and a *"cross-over"* may be made to other courses at any stage without loss of time.

The aim of the *Vocational Course* is primarily trade training, but, after completing a two years' course in this department, a boy may enter the Rochester Shop or Trade School and continue his work for three years, at the end of which time he obtains the State Industrial High School Diploma. A boy may enter this course at any time during the Junior-High School attendance provided he is over 14 years of age. Upon entrance, the boy and his parents choose the trade which he wishes to follow. He is then given a ten weeks' intensive try-out period in that particular trade. If he shows ability and, in the judgment of the instructor, will "make good", he continues in that kind of work for two years. If, on the other hand, the instructor believes that the boy is unfitted for the particular trade which he has chosen, he is then given another intensive try out in some other type of work. This try-out scheme is carried on until the boy finds his niche or until it is definitely decided that he is by nature unfitted for industrial trade work. This course varies greatly from the industrial technical one in that boys do not carry on the regular junior-high school

work. The day is divided into three hours of shop-work, one hour and a half of bookwork, including English, history, civics, and hygiene, 45 minutes of related shop mathematics, and 45 minutes of related mechanical drawing. It should be understood that the boys in this course are those who intend to drop out of school at 16, or before, and who desire an intensive trade training before going to work. Last spring over 70 per cent of the boys in this department were beyond the legal age for leaving school, and it is safe to say that nearly all of them would have left had they not been receiving definite trade training.

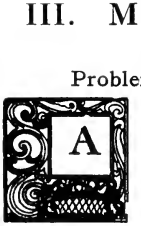
In order to care for these varying types of shop-work, the organization of the industrial department is somewhat complicated. Nine shops with eleven teachers now take care of all shop work. This is accomplished by using certain shops for vocational work half a day and for try-out work the remainder of the day. In addition to the shop teachers, the industrial department has two instructors for mechanical drawing and one for shop mathematics. At the present time, machine shop, electricity, and automobile repair are strictly vocational shops, while printing, mill work, pattern-making, sheet metal work, and painting and decorating are vocational only one-half day and then used for technical and try-out work. One teacher in mechanical drawing is handling vocational classes only,

while another is giving part vocational and part try-out drawing. The teachers of shop mathematics and vocational bookwork are handling strictly vocational groups. In no case are vocational boys and try-out boys combined in the same class.

The actual shopwork given in both try-out and vocational classes is done on standard practice machines and, so far as possible, parallels actual factory conditions of the better type. All work given is practical and usually of a productive nature. Production, however, takes a subordinate position, as it is never allowed to interfere with the all-round development of the boy. The industrial department in the school, after all, is essentially a school rather than a factory.

III. Methods of Offering Courses and Projects

Problems in Respecting Individual Differences



A LARGE number of perplexing problems confront those who conscientiously undertake to select, organize, and offer representative industrial activities designed to meet the needs of early adolescence. There always will be various difficulties which are involved in properly *reflecting* and *interpreting* the many inherent conditions and relationships in modern productive industry. But, in order to realize successful instruction in the industrial activities represented, the psychological and physiological growth of the pupils must be recognized and respected during this all-important period of development. Many useful methods have been devised for selecting and organizing the various try-out or exploratory types of industrial courses, in order to *help boys prepare themselves for the demands of many-sided service,* as well as for intelligent citizenship. These helpful suggestions were reported in the preceding pages dealing with the investigation of 379 progressive intermediate and junior-high schools, which are located in 21 different states.

This investigation and the majority of the recent school surveys make it evident that the influence of traditional practices, rather than the actual needs of our new and rapidly changing social conditions, still deter-

mines too largely the kind and amount of emphasis which the industrial experiences receive in much of the upper grade curricula. The tendency to covet this familiar conception of education, which has the imparting and mastery of that great store of knowledge in school textbooks as its aim or purpose, undoubtedly is an inheritance from those early days before the sum total of the things worth knowing had increased many hundredfold. We have an abundance of early and recent records which share this attitude toward education with Oliver Goldsmith, who in his writings modestly expressed a yearning "to show" his "book-learned skill." Despite the many evidences of this inheritance which still exist in our American school systems, it is obvious that the growing demand for education today is not so much for the mere accumulation of a mass of facts as it is for the ability to reason from facts and to learn where to find valuable information when needed. At any rate, our present difficulties in meeting the needs and respecting the interests of seventh, eighth, and ninth year boys can not be solved satisfactorily unless a reasonable amount of time is allowed for giving instruction in a fairly wide range of profitable shop experiences and the wealth of related information involved.

Industrial-Arts Instruction and Characteristics of Early Adolescence.

Much has been said and written by G. Stanley Hall and other students of psychology regarding the charac-

teristics of early adolescence, but a surprisingly small amount of suggestive material is available, as yet, for aiding those responsible for making the practical applications which are so essential to efficient industrial arts instruction. The need for adapting the methods of teaching the industrial activities to the peculiar characteristics of boys from 12 to 15 years of age is obvious to all close observers. While the nature of the instruction during this period will be determined partially by the variable types of activity represented in the different schools, nevertheless, it is now recognized that the most effective results can be realized only when the methods are flexible enough to provide for the individual differences, as well as for the varying needs of the differentiated groups.

The greater part of the schools that reported on this phase of their instruction expressed some need for representing a variety of industrial pursuits so that the experiences will be well adapted to the problems of revealing capacities and developing special interests and powers, which are in keeping with the general aims and purposes of their respective school organizations. Several even insist that this cannot be accomplished fully unless allowance is made for freedom in choice and for individual experimentation. Others place the main emphasis upon such methods for supplementing the school activities as excursions to study the larger constructions in productive industry, which they believe will do

most in helping boys of early adolescence to discover the value of their inclinations, either in positive or negative ways. Not only do some of the schools provide opportunity for each boy to try out, discover, and develop any special ability for doing and managing industrial work, but they also furnish information for maturing the pupil's judgment of industrial problems and relationships. The reports indicate that the best results have been gained by interpreting that valuable directly and indirectly related industrial knowledge which is an outgrowth of the manipulative aspects of shop experience. These rapidly developing courses thus *attempt to make provision for constructive thinking*, as well as to give contact with typical materials, tools, processes, and shop organization. The psychological foundation for this procedure is sound, as *much of the educational value in these industrial experiences will come from the various habits, attitudes, and appreciations established* in meeting both the simple and complex situations which arise with the proper responses.

Relation of Likes and Dislikes to Abilities and Inabilities.

The likes and dislikes which are fostered by boys of this age, as well as their correspondent relation to abilities and inabilities, have an important bearing on the methods of instruction given in the industrial-arts activities. A few years ago, Dr. Edward L. Thorndike of Columbia University measured the permanence in the

interests of one hundred individuals, and also the resemblance between interest in the upper grades and capacity in the college period, with the following conclusions: "These facts unanimously witness to the importance of early interests. They are shown to be far from fickle and evanescent. On the contrary, the order of interests at twenty shows six-tenths of perfect resemblance to the order from eleven to fourteen, and has changed therefrom little more than the order of abilities has changed. It would indeed be hard to find any feature of a human being which was a much more permanent fact of his nature than his relative degrees of interest in different lines of thought and action. Interests are also shown to be symptomatic, to a very great extent, of present and future capacity or ability. Either because one likes what he can do well, or because one gives zeal and effort to what he likes, or because interest and ability are both symptoms of some fundamental feature of the individual's original nature, or because of the combined action of all three of these factors, interest and ability are bound very close together. The bond is so close that either may be used as a symptom for the other almost as well as for itself."[14]

Successes and Failures Reveal Aptitudes and Abilities.

Although some promising psychological devices and tests have been developed for selecting persons for spe-

[14]Thorndike, E. L. "The Permanence of Interests and Their Relation to Abilities," Popular Science Monthly, November, 1912.

cific occupations, there is no better method in use at present for discovering the boy's capacity for each type of industrial experience represented in the school workshop than to observe the degree of success and failure as he develops each division of the work and study. A suggestive experiment also has been conducted with 24 apprenticed boys, who ranged in age from 12 to 17 years, in order to ascertain whether or not those using hand tools in a systematic and workmanlike manner in one division of industry can do tasks of equal difficulty in other industrial pursuits with about the same facility. "It was discovered, beyond a doubt, that those who were most systematic and workmanlike in the making of working drawings and wooden patterns with hand tools likewise were most successful during their first six months in the machine shop, blacksmith shop, foundry, boiler shop, pipe and sheet metal shop, or wood shop, where they issued, accounted for and used hand tools."[15] The results of this experiment, which were based upon the individual judgments of several instructors and mechanics, suggest that estimations of capacity do not differ very widely when made by persons who understand boys and the industrial activities in question. And when aptitudes and abilities have been determined even tentatively, these can be tried out and developed sufficiently to aid in *educational and vocational guidance* as the try-

[15]Edgerton, A. H., "Diversified Industrial Activities as a Means of Educational and Vocational Guidance for Seventh, Eighth, and Ninth Year Boys," Industrial-Arts Magazine, October, 1917, Vol. VI, pp. 390-392.

out courses progress in difficulty. In this way, individual interests, inclinations, and capacities are not only *revealed* but are also continually *checked* and *developed* as the activities become more intensive.

Methods of Offering Industrial-Arts Courses and Projects.

Because of the limited time available (six to twelve weeks in a large proportion of the school systems investigated), there is a tendency for most of these courses to include definite types of work to be done by all pupils. However, this does not necessarily mean that all pupils must develop the same problems and projects, or complete the minimum requirements in one kind of activity before taking up work in another. Some of the industrial departments even allow pupils upon entering new types of work, to choose between several introductory problems at hand, or to substitute work of equal difficulty. This also is the practice of a number of schools in connection with outside projects, after the boys have facility for doing a satisfactory grade of workmanship. In addition to the individual projects and problems, opportunity also is given in a number of the schools for trying out qualities of leadership and coöperation in managing construction work and groups of workers. While the student-foreman organization is the plan ordinarily employed to promote this form of group activity, there seems to be very little uniformity at present

either in the scheme of organizing or the method of conducting this promising type of work.

The *project method of learning*,[16] which has received such wide interpretation and publicity during the past few years, is favored in principle by over 90 per cent of the industrial-arts teachers in 303 of the intermediate and junior-high schools studied. As would be expected, different degrees of emphasis are given to the relative importance and desirability of having the purposing and planning of the projects done by the boys, especially in the seventh and eighth grades. A few of the instructors still require the boys to work largely from specifications and to do their work in a certain prescribed way, thus allowing little opportunity for each pupil to set up purposes or objectives and to develop plans for meeting the difficulties in their execution and for solving the problems to get results. However, the great majority of these instructors are attempting to improve upon this traditional method, which undoubtedly has robbed many boys of the larger values in the educational process by over-emphasizing both the following of directions and manipulative skill in the tool processes. Although the importance of skill and dexterity is recognized by those who have adopted the project-problem method of procedure, it is insisted that a proper amount

[16]Kilpatrick, Wm. H.: Teachers College Record, Columbia University, Vol. 21, pp. 319-335; and Snedden, David: School and Society, Vol. 4, pp. 419-423.

of technique can be realized and vitalized through profitable experiences which stimulate thinking and reasoning, as well as industry.

This method of teaching requires the instructor to analyze, simplify, and adapt subject matter to aid pupils in securing suitable information to meet the somewhat varied situations which arise in their construction problems. In addition to the necessary technical information, which aids pupils in understanding the methods and processes involved in their work, a part of the educational value undoubtedly comes from observing tools in use, samples and pictures of commercial products, projects in various stages of completion, charts of industry, and the like. It also is found desirable to have an abundance of illustrated, descriptive material always available for the purpose of *helping boys to understand and appreciate economic products, allied occupations, and vital relationships in each phase of industry sampled.* When planned carefully, such devices as excursions, motion pictures, class discussions, student reports, talks by specialists, and class or group demonstrations gain the interest and offer possibilities in furthering achievement and success.

The instructor sometimes finds it advantageous to resort to shop tricks and kinks, in order to form the desired bonds in the teaching process. In demonstrating

the proper uses of certain tools, for example, he might get the best results in determining habits and attitudes by showing their incorrect as well as their correct uses, in order that the boys may thoroughly appreciate the possible difficulties in the work provided they do not use the tools correctly. The results of experiments to ascertain the best methods for such work show that where boys are made conscious of the trouble which may be experienced or avoided, by using tools either incorrectly or correctly, there are few that do not exercise care to save themselves unnecessary waste in time and energy. "There is a tendency for teachers to depend too much upon verbal explanations, because of the convenience of words and the immediate economy of time that results from their use. If words will give the desired clearness, use them by all means; but, if nothing more than an *inadequate notion* will result from such explanation, the teacher has made a poor choice to get results."[17] Regardless of which of these methods are chosen for offering a specific unit of industrial arts instruction, it is obvious that an unnecessary waste of time and effort is certain to result from forming wrong habits, inaccuracy, or forming no definite habits at all in the work and study covered.

[17]Edgerton, A. H. "Experimental Work in the School Shop as a Means of Industrial Efficiency," Industrial-Arts Magazine, April, 1915, Vol. III, pp. 161-163.

SUCCESSFULLY TRIED UNIT COURSES IN LARGE AND SMALL SYSTEMS.

Eighth Grade Prevocational or Aptitude Courses.[18]

In the eighth grade at the Ethical Culture School, New York City, a plan has been adopted for offering three semi-elective courses which aim to be prevocational or aptitude courses. These courses are known as mechanical, printing, and art-crafts.

They are considered semi-elective because their election is determined by the coöperative considerations of the pupil, his teachers, and his parents and are based partly on his records in the arts courses. The courses are prevocational or aptitude courses in the sense that they are intended to serve as experiences that may help the students find or verify so much regarding their interests and aptitudes as appears desirable, in order to start some thought of high school courses of study and prospective careers. For example, the *mechanical course* is planned for those (1) having some interest in and liking for machinery and a desire to study and experiment along this line; (2) showing some aptitude for mechanical problems and construction; (3) desiring to find out whether they have or have not any real and well founded liking and aptitude for mechanical things.

An appreciation of what is fine and admirable in the art and science of machinery is one aim. The acquisition of a definite body of technical practices and

[18]Contributed by Arthur W. Richards, Director of Manual Arts, Ethical Culture School, New York City.

knowledge of elementary metal working processes, tools, and materials is also intended. This course consists of a study of the design, operation, mechanics, and construction of some good and industrially important mechanical project such as the steam engine. The general nature of the content, the organization, and the methods of instruction in this course are briefly as follows:

Instruction cards, charts, and models used are:

1. Steam engine working chart.
2. Gas-auto engine working chart.
3. Operating steam engine, reciprocating and turbine.
4. Operating hot air engine.

Outside study assigned on these special topics with specific references given for each includes:

1. How the steam engine works.
2. Valves.
3. Boilers, types, flash, everyday engineering.
4. Types of steam engines.

Excursions made are:

1. To 59th Street or other power stations.

Social content studies involve:

1. History of steam engine and inventors as vocacational inspirational matter.
2. The industrial and social importance of the steam engine.
3. Other power engines and the future of steam engines.
4. Vocations based on mechanical work interest.

Organization plan includes:

1. Class project to consist of a lot of engines which are carried to point of assembling. Individual students are to assemble, adjust, and finish one or two engines from the finished parts.
2. Individuals (1) to be assigned lot part jobs, (2) given problems to solve, (3) assigned duties necessary to advance the project.

Methods of personal instruction are:

1. To be on an individual problem or task basis.

2. To have teacher's demonstration on new, unknown processes made largely to individuals, and class lectures to be very short.
3. To allow pupil instruction to other pupils as the jobs are transferred.

Cabinet Making Organized on a Useful and Productive Basis.[19]

With the opening of the Jefferson Junior-High School at Rochester, New York, last February, certain shops in the industrial-arts department were used during half of each day for specific trade work, while the other half day was reserved for the general industrial arts work. One of the shops thus dividing its time is the cabinet-making shop. This shop was equipped with individual motor-driven machines of the most modern type, in order to do a high grade of productive work. The industrial-arts courses were organized around certain well analyzed projects, which involved the principal machine and hand woodworking processes and operations in their construction. All work of both classes was done on group projects. The shop was organized and conducted much like a factory, with a superintendent and foreman and the work routed through on a production plan. Each boy received a daily assignment to a job or a machine but no boy individually completed a whole project. That is, the principle of the division of labor was applied but it was not carried to the point of exploitation, as none of the boys were kept upon a par-

[19]Contributed by Harmon B. Wood, Instructor at Jefferson Junior-High School, Rochester, New York.

ticular job longer than was necessary in order for them to become thoroughly proficient in understanding and doing the work involved. There was always the finest kind of interest in the work on the part of the groups.

During the half year about one-fifth of the shop time was spent in oral group instruction on matters of trade theory and science, as well as in discussions of the problems which had arisen in the shop.

The writer believes that this method of organizing and conducting a school shop maintains a better interest, gets more and better work done, and develops a finer spirit than can be done under the individual, complete-project plan, without sacrificing anything in the way of real instruction. In addition, the shop output is immensely increased. During the last half of last year the output of this shop included twelve teachers' desks, 36 drawing tables, thirty pedestals, sixty flag standards, twelve dining-room tables, eight library tables, five 40-drawer cabinets, two hundred drawers for the sewing classes, one flag case, two medicine cabinets, and one speaker's table.

Practical Course in Electricity.[20]

The course in Electricity offered in the Duluth junior-high schools was begun in 1917. It is presented in the eighth grade for one semester as a part of the system of rotating various subjects in the seventh and

[20]Contributed by James A. Starkweather, Assistant Superintendent of Schools, Duluth, Minnesota.

eighth grades for the so-called prevocational groups. The buildings had very little equipment to begin with. Practically all of the wiring for circuits and for the setting up of the instruments and switch boards has been done by the boys in the classes. Some of the equipment has been made by the students. Some has been purchased through the junk-man, and the necessary repairs have been made by the boys. The expense of these shops compared to the amount of equipment found in them is relatively very low.

This course has been prepared in units, each unit representing a certain particular branch of the subject. These units have been placed on a chart which shows the correlation between electricity and the other subjects which the students take at the same time. It indicates the teaching units, the shop and laboratory work, the electrical theory, the related science, the drawing and sketching, the mathematics, the spelling of terms used in the study, and something of the history of the inventions and discoveries.

There has been no subject offered in the Duluth junior-high schools which has had a more absorbing interest for the boys. Students who have shown exceptional interest and ability in the subject have, on the recommendation of the teacher and consultation with the principal, been allowed to take on an advanced course in

this subject in the ninth year. In cases where these boys have been compelled to go to work early, and there have been several such cases, they have secured work in the electrical trade at good wages. One particular instance is illustrative of this point. C. R., who was a student in the eighth grade, was rather a bright boy, but, on account of the economic conditions in his home life, he found it necessary to go to work. He was an excellent student in electricity. With some little assistance, he was encouraged to remain through the ninth grade and continue his course while taking the other subjects. At the end of the ninth year he left school and immediately entered the employ of an electrical firm at good wages. He is now occupying a responsible position in one of the leading electrical firms in Duluth, at a salary better than that which his teacher is receiving. He had previously been rolling barrels in a lime kiln after school.

Several other boys who have completed high school have continued their work in science due to the interest aroused in the electricity course. Many of these boys are entering the university in the various fields of engineering. This would not be remarkable were it not for the fact that electricity furnished the interest and enthusiasm for keeping these boys in school during the period of adolescence and tided them over the discouraging time of failures in English and algebra.

Electrical Construction and Repair.[21]

The course in electrical construction at the Garfield junior-high school, Richmond, Indiana, had been carried on previously in lecture form almost entirely. The results were not quite what were wished and, therefore, we began casting about for a plan which would interest the boys more than this course already had done. A very limited equipment prohibited us from allowing the boys to experiment with the usual delicate apparatus about the shop, but yet we believed that the boys of junior-high school age almost demanded construction work which they could do for themselves. To use what we had on hand would have meant that quite soon every piece of apparatus would have been taken apart, with the result that there would then be but a few parts in working order.

A way presented itself soon after school started, when a boy brought a disabled electric train to school and asked to have it fixed. He was told to choose some boy from the class to help him and was then given permission to work on the engine during the class period. Other boys in the class who saw the two experimenting and working together complained of their lot. Some even asked why they must sit and listen to lectures while two of their number were allowed to work on real problems. They were told also to bring in some work which

[21]Contributed by Walter B. Miller, Instructor at Garfield Junior-High School, Richmond, Indiana.

needed repairing and that they, too, might then enjoy those same privileges. On the next day, the shop was transformed from a stiff electrical laboratory, where long lectures drove the boys to hating school, to a practical electrical workshop, where groups of interested boys, with heads together, worked out the repairs for broken toys which had been accumulated over night from cellars and attics about the town. Of course, it is needless to state that we continued to work along that line for the rest of the term. As the repairing of toys played out soon after Christmas, we asked the boys for broken electric irons, vaccuum sweepers, etc. For some time the patrons of the school hesitated before entrusting the boys with their household appliances, but finally we won them over and were kept busy calling for and returning their goods. Unless some new part had to be bought, we charged nothing for our work, and even put a guarantee on it, which was something the local electric shops had not done. We kept account of the work, as the repairs were made, and the cash value of the whole year's work would have been a little over five hundred dollars, provided we had charged the regular prices.

We usually had enough repairing to do to supply every boy with some work. Each class was considered as a separate unit or shift. Each boy who was entrusted with a job was given a helper and held responsible for

both job and helper. Over a group of three or four of these workmen was placed a foreman, whose duty it was to help the boys out of difficulties and instruct them according to the orders of the general foreman, who was in charge of the whole class. The leaders soon began to show themselves and, after many adjustments, were placed where they could help and learn most. They usually held foremanship positions because of their willingness to help the boys on jobs which gave them trouble. When the classes began, the general foreman would have received his instructions from the teacher and would have told the tool-room man what new problems had been brought to the shop, to whom to give them, where to find any new tools that might be needed, and also would have announced the names of those who were to be the foremen for the day.

The work was quite successful from the standpoint of interest, as each boy had brought something from his home or from the neighbors and had actually repaired some machine or appliance concerning which he had known but little before. It should also be stated that cöoperation with the school wood shop made it possible for the boys to wire the lamps which they had made. One proof of the interest was the landslide of business in electric toys, wireless and telegraph instruments, etc., at the local electrical shops.

SUGGESTIVE TYPES OF INDUSTRIAL-ARTS PROJECTS AND PROBLEMS.

The Doll House as a School Project.[22]

In the Hastings, N. Y., Schools there was need for a doll house in the kindergarten room. This furnished a problem which was taken up as a school project. Its construction required many of the different processes and materials that are necessary in the construction of a home. Nothing is gained if a project presents problems which are too simple or too difficult; or, in other words, if it contains no real problems at all as far as the pupils are concerned. For this reason, in planning this project, the physiological and mental ages of the pupils were considered and the work was divided accordingly. The scheme of work followed was as representative as possible of the actual construction of a house in the field.

It was a "community" project which furnished work of a practical nature and developed an appreciation of coöperation. It gave the pupils an opportunity to use their constructive instincts and capacities in a beneficial manner. It helped them to get the habit of planning to meet their own needs and assisted in making them "handy" about the home and elsewhere, as needs arise. Even though the work was divided among the pupils to meet their capacities, as far as the actual doing of things was concerned, they were always in touch with the other

[22]Contributed by Wm. H. Peters, in charge of industrial arts. Hastings, New York.

processes going on through observation and discussion. Thus they received instruction in the industries from which man gains his material possessions and studied the industries for the sake of a better perspective on man's achievements in controlling the production, distribution, and consumption of the things which constitute his material wealth.

Method of Procedure. This real desire for a doll house in the kindergarten room suggested the idea of drawing a few rough sketches in the way of explaining what was wanted. From these sketches and a few necessary suggestions, two boys from the mechanical drawing class took the responsibility of the architects, and as a part of their work in the class completed, after much designing, plans for the house. These plans consisted of scale drawings of the front, side, and rear elevations for the first and second floors. As in an architect's office, tracings were made from these drawings and finally each boy in the class made several blueprints from them, so several sets of plans were completed. The methods used in an architect's office were taken up and a study of the vocation was made, thus giving the boys an insight into the field of drawing. Specifications were then drawn up by the architects and sets of these were typewritten by the commercial class.

After these plans and specifications were first checked up by the eventual owner, they were given to the industrial-arts department, which had agreed to take

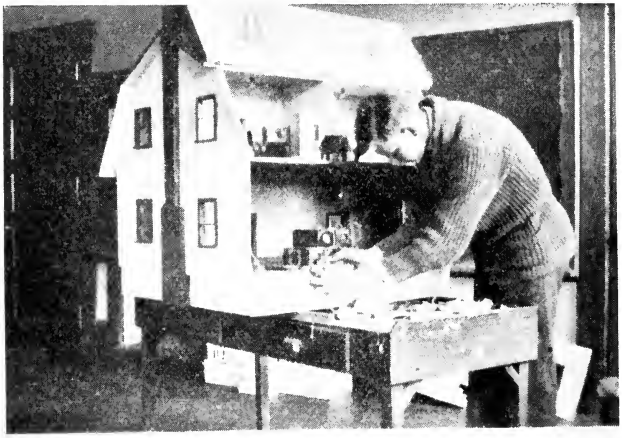
the general contract. Two boys from the advanced class assumed the responsibility of general contractors. They were checked up by the architects, who saw that the plans and specifications were being fulfilled. They, therefore,

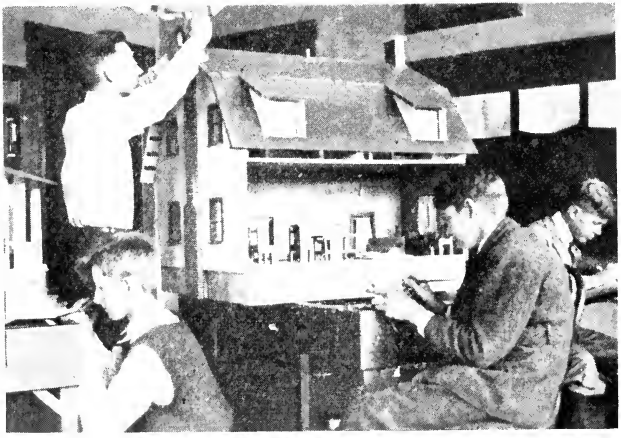
FIGURE V.

Several Group and Individual Projects Were Involved in the Planning, Construction and Furnishing of This Doll House for the Kindergarten.

kept in touch with each part of the construction and learned in a practical way the "why" of doing the various things involved in constructing the doll house shown in Figure V.

There was no real masonry work to be done, as it was decided not practical in the construction of a doll house; however, the masonry was not neglected, as the boys felt the need for it and suggested many schemes to





FIGURES VI AND VII.
The Upper and Lower Illustrations Show an Individual Project in Installing Electric Lights and a Group Project in Painting and Finishing.

work it out. This led to a discussion of the many methods of building foundations and chimneys. The proper proportions for mixing the ingredients for a concrete floor were taken up and the boys made use of their previous study of concrete, which had consisted of a study from the rough rock from which the cement is manufactured to the finished product, the different methods of mixing with aggregates in their proper proportions, and the making of such problems as bird houses, flower boxes, etc., which involved reinforced as well as mass construction. In this way and by making miniature urns and flower boxes out of concrete for the doll house, the boys got all of the necessary principles and a "taste" of the work in concrete.

The carpentry in the house offered more chance for actual work. There were many details to be looked after and so a carpenter-contractor was appointed. He in turn picked several boys to act as foremen; a foreman for each group that worked during each of the different periods. The different groups or journeymen were held responsible by the foreman. They in turn were held responsible by the carpenter-contractor, who was subject to direction from the general contractors. They were checked up by the architects, whose job it was to see that the owner's plans and specifications were fulfilled. The boys felt the responsibility of their work and gave all their efforts to seeing that their part of the job was ful-

filled. It was necessary for them to read the blue-prints to carry on their jobs, consequently the boys became familiar with working drawings.

Plumbing and fixtures for the bath room and kitchen were given over to one of the boys in the sheet metal class. The bath-tub and most of the other fixtures were worked up out of discarded tin cans, which adapted themselves very readily to the shapes desired with very little cutting, shaping, and soldering. The specifications called for electric lights, which a boy is shown installing in Figure VI., and an electric bell. Some of the boys who were taking the advanced shopwork were working on electrical problems and, after listening to several lectures given by the teacher of physics, understood the principles of electricity fairly well. But the complete system of wiring a house had not as yet been worked out. This afforded a very good practical problem in physics, and so plans and specifications were given over to the physics class. The contract for the painting and interior decorating was taken by the art classes. In Figure VII a group of boys is shown developing the plans for finishing. The work on the curtains, and the like, was likewise taken over by the domestic arts classes.

Furniture for the house was made by the different grades. Different grades furnished different rooms. They seemed to take great interest in this work and the

contractor, foreman, and journeymen scheme worked out very well. One grade decided it would like to make the furniture for two of the bed rooms. Before permission was given to start, the members of the classes were asked how they would organize the work so that they would only have the specified furniture when finished. After a few suggestions, they decided that they would carry on a system similar to methods used in the industries. The job was turned over to them. The class president took the floor and a meeting was called to order. There were nominations and a contractor was elected as also were two foremen. The rest were the journeymen, and they were divided in two groups by the foremen. Each foreman and his group took opposite sides of the shop, while the contractor took the responsibility of the whole affair, leaving the instructor with very little to do. Another class took the contract for the making of the furniture in the living room, and worked out their ideas with the help of their class teacher. The manufacturing of the trim for the house was another problem, and it was taken by another grade which worked a factory system scheme. Visits were made to factories and their systems noted.

The actual cost of the material used in the house was taken up as a practical problem in arithmetic. It included the finding of the number of board feet, and the making out of the bill of material. The wood of which it was constructed was studied in the science, geography,

and industrial-arts classes by tracing the story of the lumber used from the seed to the finished board. The English class made very good oral reports on the project and also wrote an interesting account of it. In following the above scheme, nearly every department and pupil was represented as having some important part to play in the project.

Projects in Concrete Construction.[23]

When School Number 22 at Buffalo, New York, purchased a universal saw and motor with the proceeds of candy, ice cream, and paper sales, the boys in the ninth grade manual-arts class undertook the erection of a suitable base for the new motor. Heretofore their work had been principally in wood and iron, so the construction of the necessary forms was a relatively simple matter. However, sand, gravel, and cement having been provided, the boys donned their overalls and jumpers and began to mix concrete in a workmanlike manner. When the mixture reached the proper consistency, it was poured into forms that the boys had made, fastened by the approved method, inspected, passed, and, in due time, utilized for the installation of the new motor. Since then, the motor has been in constant use and the concrete base is standing up under this test so as to prove that the boys' work compares favorably with that of any contractor.

[23]Contributed by Carl R. Kraus, Instructor at Public School Number 22, Buffalo, New York.

After this initial success, there was naturally no abatement of enthusiasm when the lads began their next project; especially as its objective was turning a muddy back yard into a real playground. A handball court was the first unit of construction. Mixing the concrete, laying the foundation course, applying a finishing coat, and marking it properly improved the understanding and technique of the youthful builders and provided School Number 22 with a royal battle ground for many a hard fought game of handball.

Next in order of time and of difficulty was the making of a basketball court. The boys laid this job out carefully according to accurate measurements, for which they were held responsible, dug holes, and mixed and poured the concrete, in which they set necessary posts for the baskets. Laying out a baseball diamond, making forms, and pouring concrete for bases followed as a matter of course. This work was performed with as much zeal as are the baseball games it made possible.

Designed originally to apply in the solution of practical problems in industrial-arts instruction for ninth grade boys, the work in concrete has been a source of real pleasure, as well as profit. Without exception, every boy has been impressed with the necessity for absolute accuracy, has had awakened within him a love for real labor, has seen opening before him the doorway to a wider knowledge of industry, and has felt the satisfaction that comes from achievement.

Model Building Construction Projects.[24]

On account of the extensive local building at East Orange, New Jersey, we felt that our boys in school should receive a solid foundation in the theory and practice of building construction. Through the close correlation of our drafting department, we were able to secure plans and specifications of simple buildings, such as garages, bungalows, and dwelling houses of the average type.

The automobile garage was featured through this project, and we were able to work into shop foremanship and group arrangement with marked success. The garages were built of wood, with concrete floors and catch basins, framed and finished to comply with the building laws of New Jersey. The scale used was 1½ inches to the foot. In some instances gray cardboard was substituted for wood in shingling, as it well represented slate and was much easier to handle.

Model Garage Construction Projects.[25]

A class of eighteen eighth grade boys at the Burnet Street School, Newark, New Jersey, undertook the building of model garages as their projects for the intensive five-week cycle of shopwork. The models were of frame construction, being made to one-eighth the size of an actual garage. They were 18 inches wide, 30 inches

[24]Contributed by Ernest W. Tuttle, Director of Practical Arts at East Orange, New Jersey.

[25]Contributed by Arthur T. Giblin, Instructor in the Burnet Street School, Newark, New Jersey.

long, and 12 inches from sill to plate, the pitch of the roof being one-third. Six garages were planned and completed.

This class was divided into groups of three, one boy in each group acting as foreman. He was held responsible for the quality of workmanship on his model and the completion of the work within the specified time. The other two boys worked under his direction. These boys showed great interest in the making of the project, and there was much competition between the groups. Talks on timber used in construction; proper sizes of sills, plates, studding and rafters; window framing; garage door building; and the use of the steel square helped to enliven the work.

The art department of the school was consulted as to the color combinations best suited for painting the garages. At this time, the subjects of ingredients necessary for making good paint; the methods of mixing and application of the same were taken up. The boys of the several groups mixed and applied the paint to their particular models, as each one was painted according to a different color scheme.

As the school is located in the heart of a zone where much building construction is carried on, several visits were made to construction jobs in the vicinity. These trips were followed by discussions of working conditions in the building trades, wages, hours of labor, and also the city's building code. The garages, which were sold

to members of the class at a price covering the cost of the materials used, were of such a size as to make them desirable for doll, dog, or rabbit houses, as well as studies in frame construction.

Ballot Boxes and Folding Booths as Community Projects.[26]

Teachers of industrial arts are beginning to see that many of the school projects which have been developed in their shops have had little practical application and vital connection with community life. Community projects and problems should constitute a relatively large portion of the school curriculum. It is just as cultural, and far more beneficial, to choose some of the great problems of the community with which to teach students through typical projects how to investigate and find out a solution to some of the things with which they must come in daily contact.

Since women have the right of suffrage, it follows that they should receive careful instruction in the art of voting; but it is also essential that boys and girls of secondary school age should receive this instruction, as the responsibilities and burdens of the government will eventually fall upon their shoulders.

Ballot boxes and folding booths similar to those shown in Figure VIII are necessities in an election in many communities and are, therefore, purchased from

[26]Contributed by Roy S. Ray, Instructor at Shelbyville, Indiana.

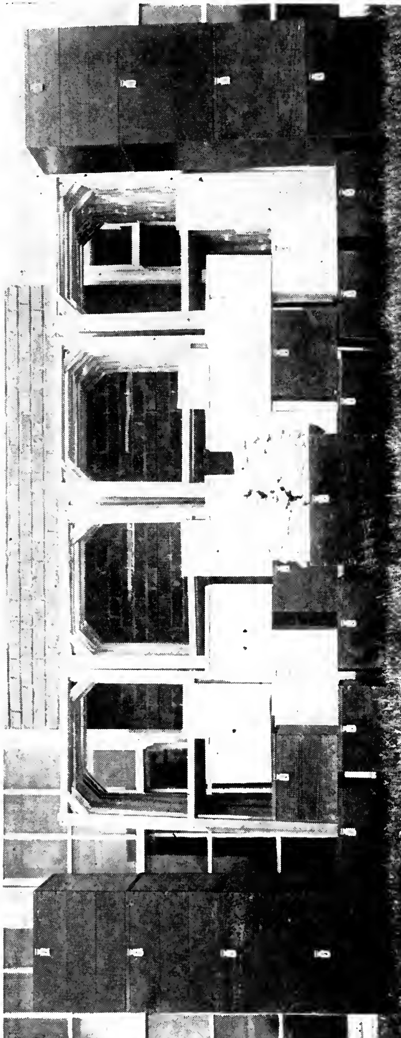


FIGURE VIII.
A $256 Order of Ballot Boxes and Folding Booths Which Was Developed as a Community Project by Pupils at Shelbyville, Indiana.

time to time. No better projects for introducing the study of government could be made in the school shops than these two types of construction. County commissioners at Shelbyville, Indiana, are willing to buy those which are satisfactorily made, and, in many cases, even offer encouragement by placing large orders valued from $100.00 to $256.00. While this is an excellent kind of community project, it also is one of the means of instilling real "Americanism" into public school work.

Making and Operating Radio Instruments.[27]

In planning the work for classes in this all-year alternating school at Newark, New Jersey, it became evident that new problems should be introduced and that some medium other than wood must be used, as the majority of boys entering the upper grades had made all of the models and pieces that could be constructed of wood in the elementary school shops. Radio telegraphy has been introduced very successfully in the eighth grade. The boys in this study of "wireless", as it is popularly known, soon grasp the fundamentals of radio operating. They study the code at home, practicing and reviewing it each period for ten minutes. It is remarkable how quickly they master the key in transmitting messages. During the course they make mechanical drawings of the instruments to be constructed and also draw several plates of radio symbols.

[27]Contributed by George F. Bowne, Instructor in the Lafayette School, Newark, New Jersey.

The making of radio instruments brings a new material, metal, to these boys. The boring, filing, grinding, and polishing of the brass parts used in the construction demand absolute accuracy. The wooden parts are all squared and shaped, and then stained mahogany, after which these are varnished and rubbed. The mahogany finish gives a very pleasing result with the polished brass.

Several types of mineral detectors are made by the pupils. The brass strips are bent, soldered, and assembled; the threads are cut and the holes are tapped; while the knobs are cut and shaped from dowels. Two kinds of condensers used in radio telegraphy are assembled. One is of tin-foil and waxed-paper for the receiving sets, and the other of tin-foil and French-glass for the transmitting sets. Each condenser is enclosed in wood. Tuning coils and loose couplers of various sizes are wound on card-board tubing. This requires skill and patience. Some boys assemble their models on base boards, others use panels, and still others make up their sets in units. All instruments are tested and must function before they leave the shop.

During the construction of these models the theory and practice of transmitting and receiving radio messages go on. At the end of the term the boy is capable of operating his own station. By thus varying the models and materials throughout the course, we hold

the interest of the boy, avoid the monotony of repetition, and secure results that have a commercial as well as an educational value.

Model Motor-Boat Building Projects.[28]

The little water crafts which were made in the Hillside junior-high school at Montclair, New Jersey, ranged in size from 24 inches to 36 inches, and were very popular at the annual Montclair Boat Races that were held last June. Each boat was trued up so that its lines were very much like the large boats, which were approximmately seventy-five feet long. They were all provided with the details and finish or equipment that go to make model-boating a source of real pleasure and recreation.

About one-half of the school year was taken up in completing either type made, but, nevertheless, they were worked out at a commercial profit to the builder. The boys received a great many kinds of shop activity, such as soldering, the use of taps and dies, working in sheet metal, and doing many operations with wood-working tools. A small electric motor is recommended for these motor boats. It should weigh not more than 15 ounces, measure only about three and one-fourth inches, and be equipped with a reverse switch. The motor should be well designed, both electrically and mechanically, and wound for battery current only. It is suggested that the motor should be made with field pieces of good wrought

[28]Contributed by John W. Cavileer, Instructor at Junior-High School, Montclair, New Jersey.

metal; that the armatures be constructed of charcoal irons, laminated and well balanced; and that the brushes be made adjustable. When completed, the speed of these boats varies from six to ten miles an hour.

In connection with these boat studies, essays and descriptions were written in the English class; the cost of materials was calculated in the mathematics department; the shipping problems were discussed in the geography class; the art classes made sketches for several posters and also a design for the front of the school paper; while the print shop printed the necessary posters, schedules, and programs for the races.

The annual races held by the public schools are very popular and have been growing more and more each year. Last year nearly 200 boats of all types took part. Gold, silver, and bronze medals were given for workmanship, as well as for speed. Several cups were also given by friends of the school system.

Teaching Cooking to Boys and Furniture Construction to Girls.

An interesting experiment was tried in the Abington Avenue School at Newark, New Jersey, during the past summer. For a portion of the term, girls and boys interchanged their special activities; that is, the boys took cooking while the girls went to the shop. As this is an all-year and alternating-class school, opportunity

[29]Contributed by Melvin E. Barnes, Instructor in the Abington Avenue School, Newark, New Jersey.

is given for a greater development of special subjects than is possible in the old type of school, although all subjects are handled on a try-out or prevocational basis.

This is one of the few Newark schools where gardening is continued with war-time fervor, and the garden is one of the reasons for the boys' cooking class. Products of the cultivated lot always have been used for demonstration purposes in the girls' cooking classes, and it was found that this increased their zeal in both departments. Lessons on food values with practical demonstrations in the preparation of vegetables, it was thought, would increase the boys' interest in gardening. No attempt was made to give the detailed course in domestic science, as it is organized for the girls, but the groups of boys on whom the short series of cooking lessons was tried learned some basic facts of food values and some methods that may prove valuable on camp outings.

Home-makers are often required to give first-aid to damaged furniture, and knowledge of how to drive nails straight might be listed with the household arts. The girls, who had exchanged classes with the boys, learned some first principles of wood working. Because the Abington Avenue School is on the alternating or modified Gary plan, both of these courses as given regularly are very extensive. The girls are thoroughly instructed in canning and preserving, as well as in preparing fresh foods.